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Title: Influence of topography and vegetation heterogeneity on wildfire in
Earth System Models

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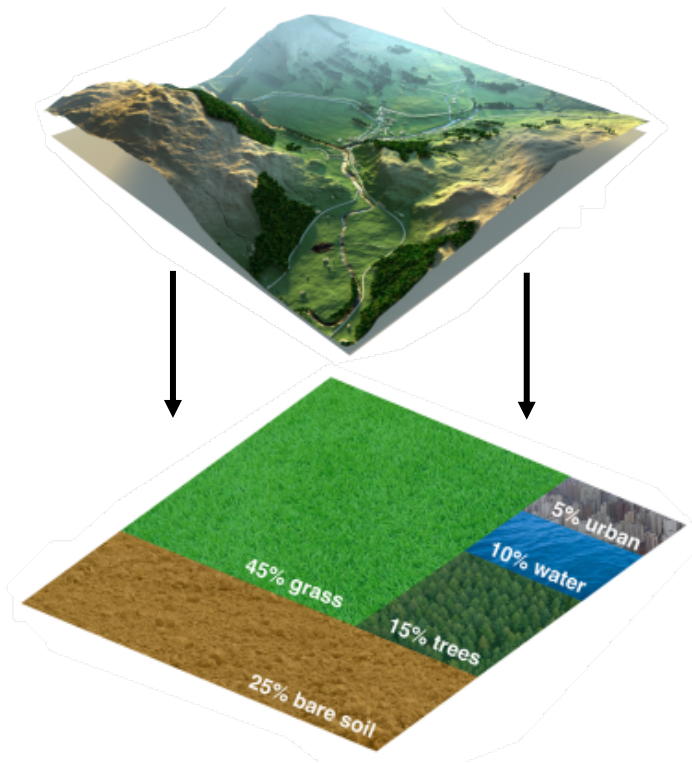
Influence of topography and vegetation heterogeneity on wildfire in Earth System Models

Julia Oliveto

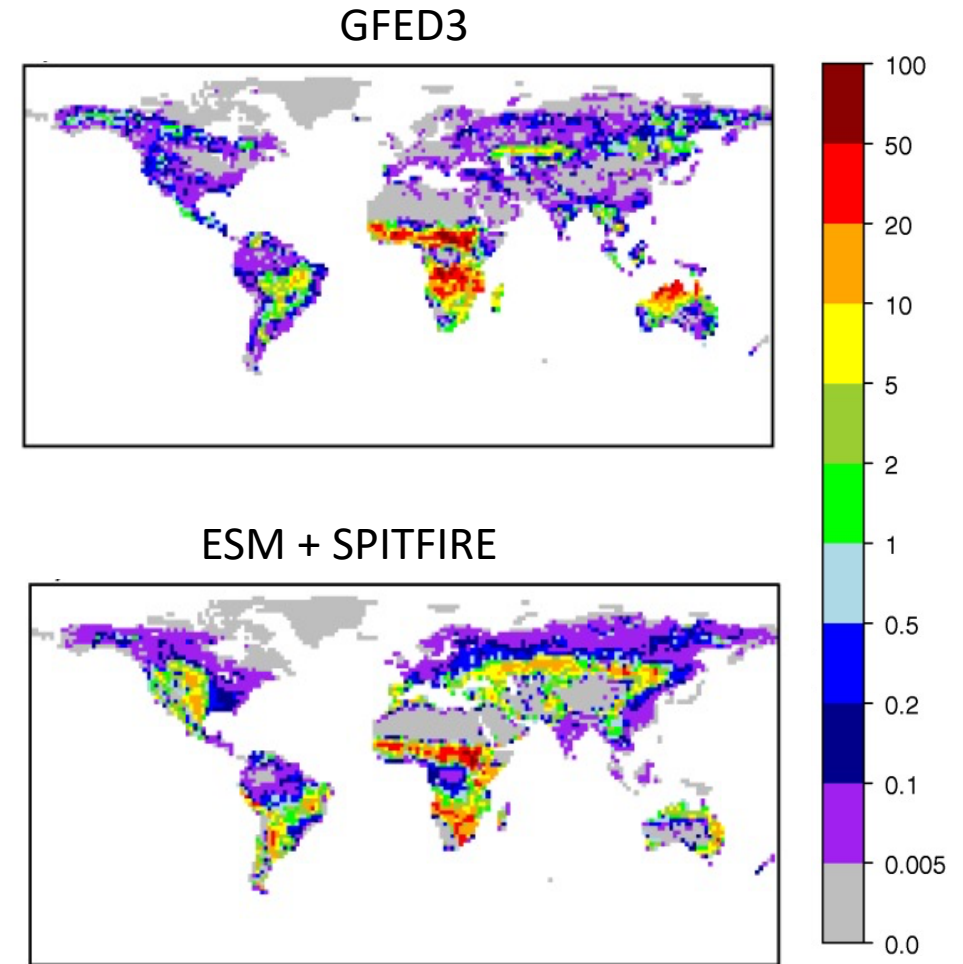
LANL PI: Alex Jonko

FSU Advisor: Neda Yaghoobian

Motivation - Earth System Models (ESMs) and SPITFIRE

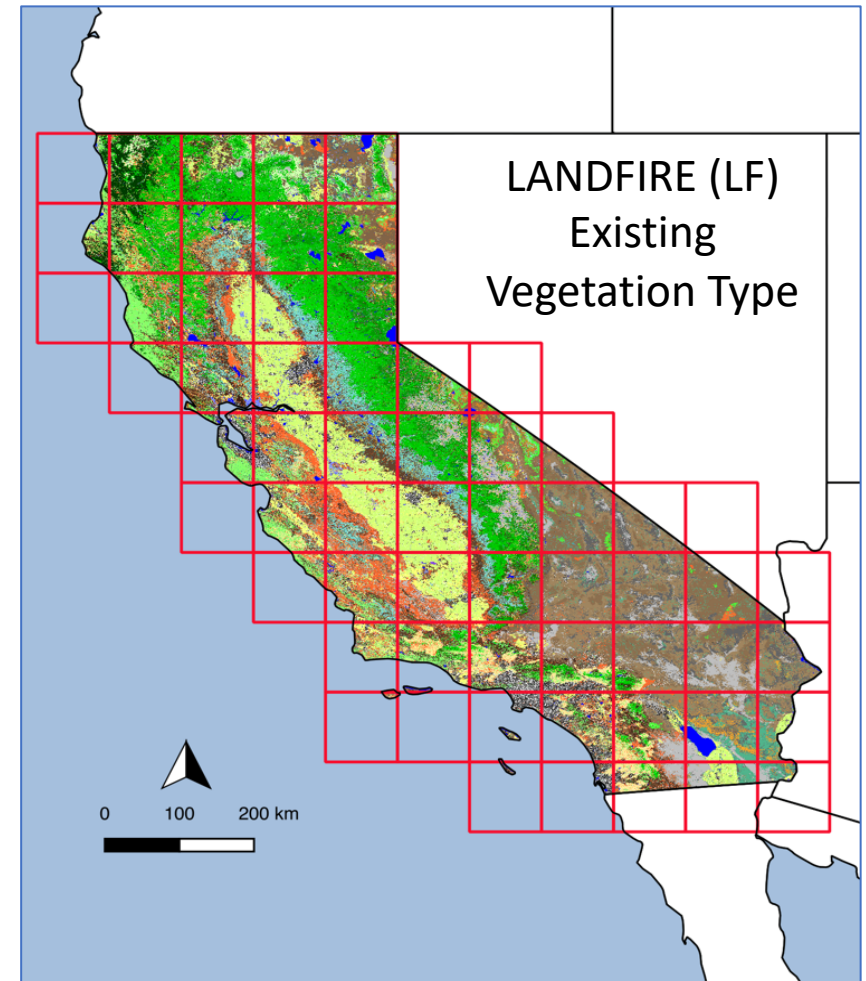
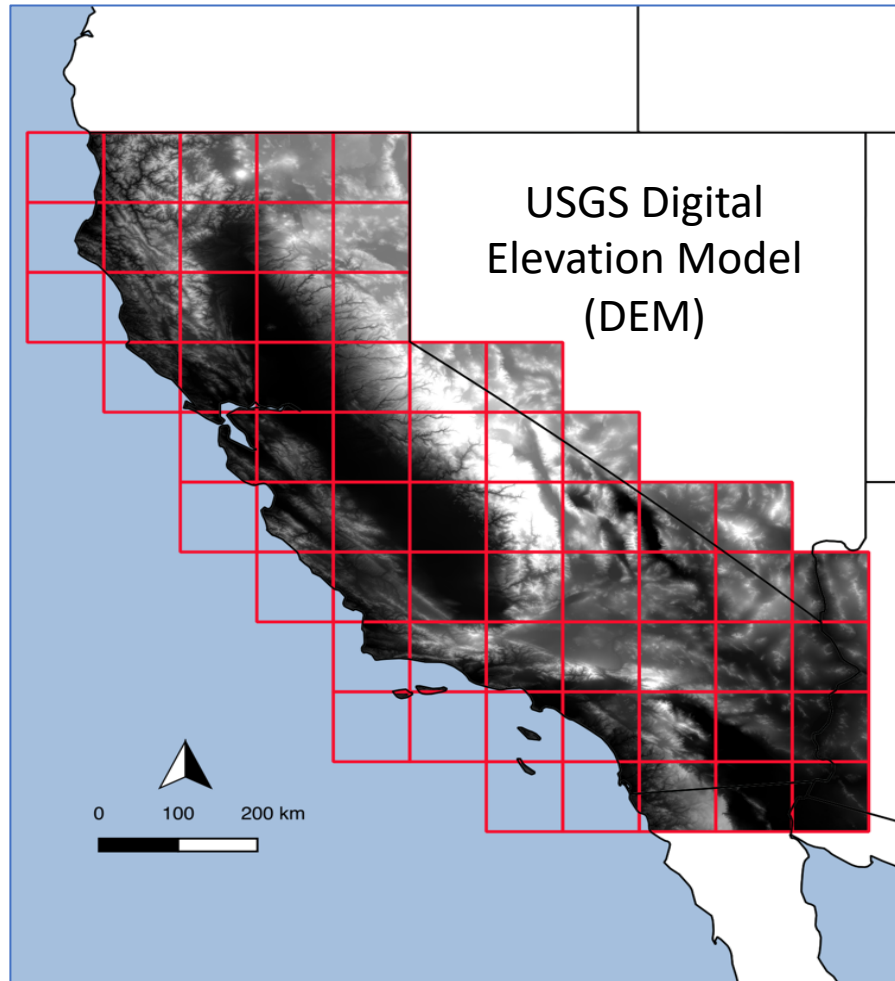


- Considers no sub-grid topography
- SPITFIRE uses Rothermel fire spread model



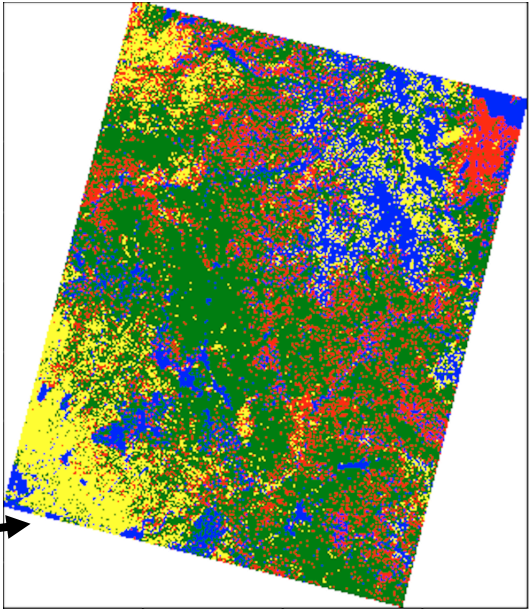
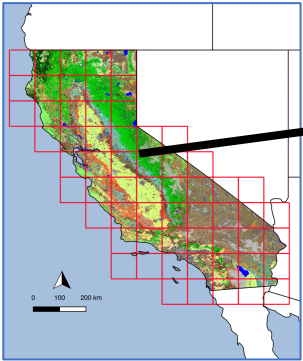
Burned fraction averaged over the years 1997–2005^[1]

Project Overview



(1) LF Reclassified Vegetation Types:

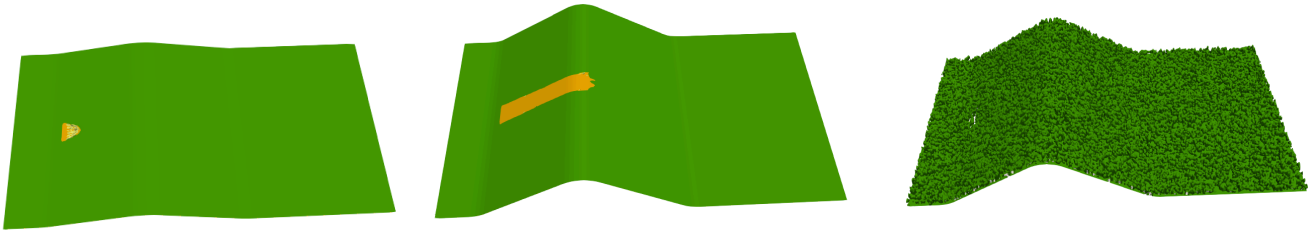
- Non-burnable
- Trees
- Grass
- Shrubs



(2) Slope, LF Vegetation Cover %, Height Distributions of Reclassified Tiles:

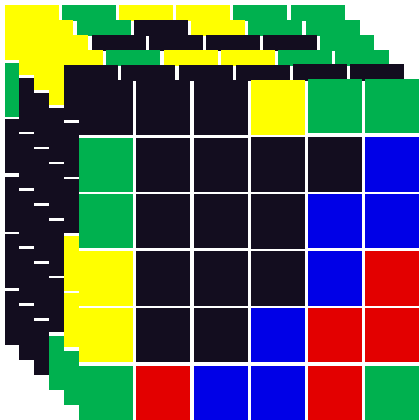


(3) FIRETEC Simulations & Response Function

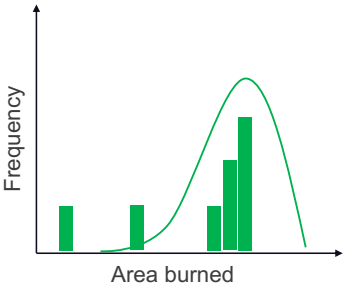


no spread up or downhill =	0,0
spread uphill not downhill =	1,0
spread uphill and downhill =	1,1

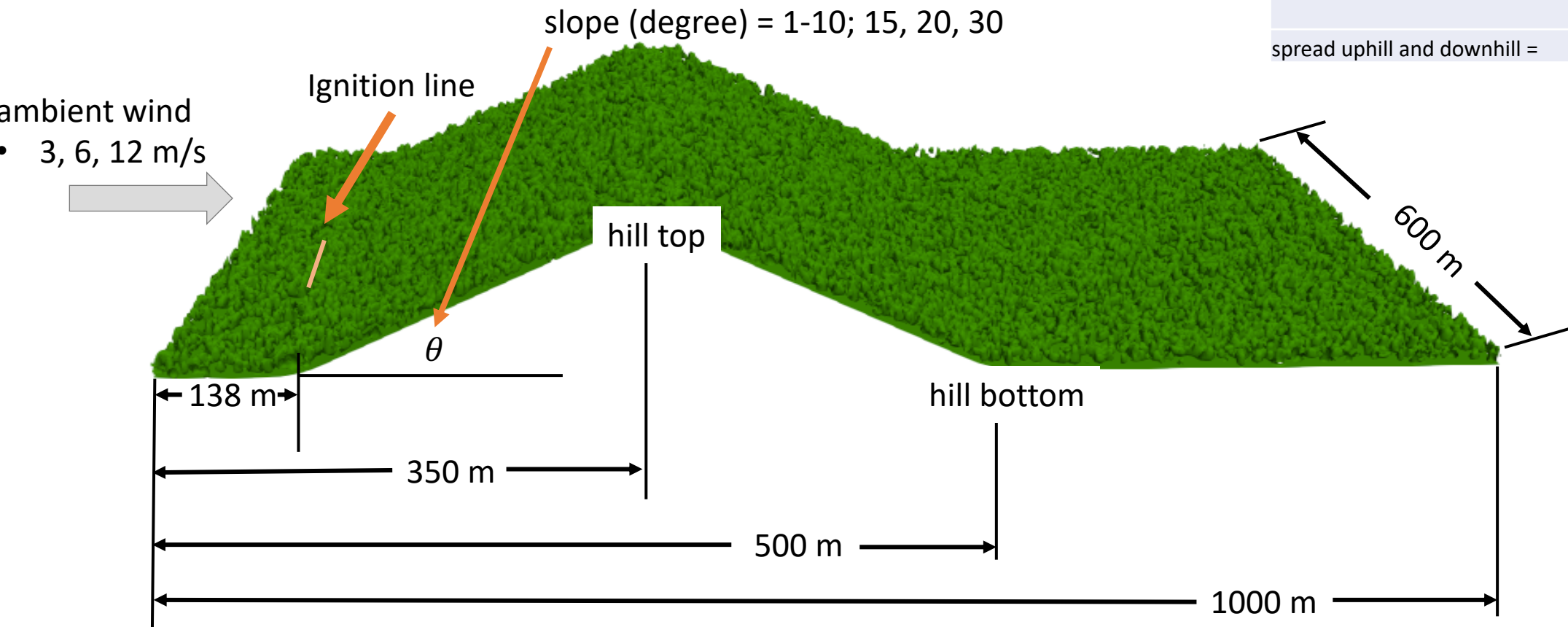
(4) FIRETEC Response Application



- Non-burnable
- Grass
- Shrubs
- Trees



FIRETEC Simulations



EX:		
no spread up or downhill =		0,0
spread uphill not downhill =		1,0
spread uphill and downhill =		1,1

- Specific Grass Suite Parameters:
- Height = 0.3 m
 - Fuel load = 0.5 kg/m³
 - Fuel moistures = 5, 10, 15, 20%

FIRETEC Results : Grass

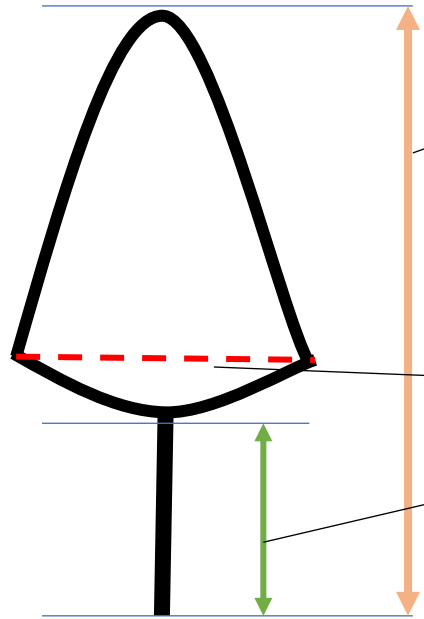
no spread up or downhill =	0,0
spread uphill not downhill =	1,0
spread uphill and downhill =	1,1

Wind = 3 m/s				
slope / FM	5%	10%	15%	25%
1	1,1	1,0	1,0	0,0
2	1,1	1,0	1,0	0,0
3	1,1	1,1	1,0	0,0
4	1,1	1,0	1,0	0,0
5	1,1	1,1	1,0	1,0
6	1,1	1,0	1,0	1,0
7	1,1	1,1	1,0	1,0
8	1,1	1,0	1,0	1,0
9	1,1	1,0	1,0	1,0
10	1,1	1,0	1,0	1,0
15	1,0	1,0	1,0	1,0
20	1,0	1,0	1,0	1,0
30	1,0	1,0	1,0	1,0

Wind = 6 m/s				
slope / FM	5%	10%	15%	25%
1	1,1	1,1	1,1	1,1
2	1,1	1,1	1,1	1,1
3	1,1	1,1	1,1	1,1
4	1,1	1,1	1,1	1,1
5	1,1	1,1	1,1	1,1
6	1,1	1,1	1,1	1,1
7	1,1	1,1	1,1	1,1
8	1,1	1,1	1,1	1,1
9	1,1	1,1	1,1	1,1
10	1,1	1,1	1,1	1,1
15	1,1	1,1	1,1	1,1
20	1,1	1,1	1,1	1,0
30	1,0	1,0	1,1	0,0

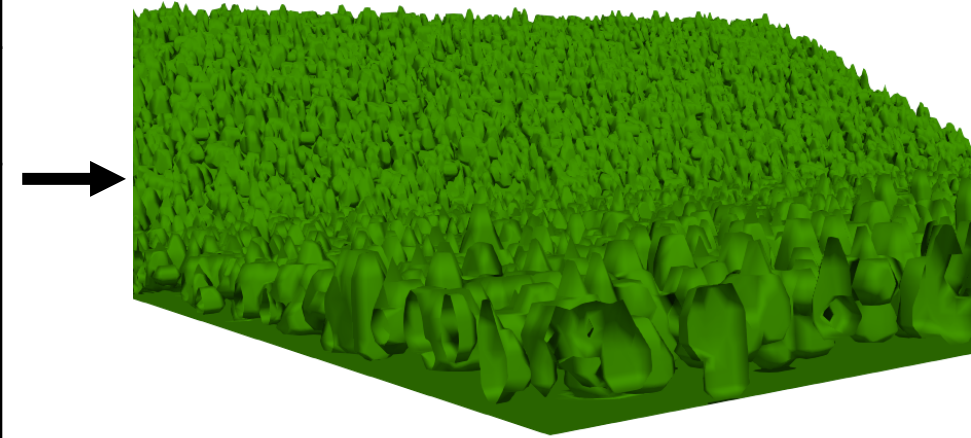
Wind = 12 m/s				
slope / FM	5%	10%	15%	25%
1	1,1	1,1	1,1	1,1
2	1,1	1,1	1,1	1,1
3	1,1	1,1	1,1	1,1
4	1,1	1,1	1,1	1,1
5	1,1	1,1	1,1	1,1
6	1,1	1,1	1,1	1,1
7	1,1	1,1	1,1	1,1
8	1,1	1,1	1,1	1,1
9	1,1	1,1	1,1	1,1
10	1,1	1,1	1,1	1,1
15	1,1	1,1	1,1	1,1
20	1,1	1,1	1,1	1,1
30	1,1	1,0	1,0	1,0

Fuel Bed Creation : Trees & Shrubs



	TREES	SHRUBS
LANDFIRE		
Average Height (m)	13 +/- 6	1 +/- 0.5
Cover (%)	49	41
Species	Ponderosa Pine	Chaparral
Downscaled Live Fuel Moisture Content (%)	80, 85, 90, 95	65, 70, 75, 85
Linn, et al		
Crown diameter (m)	7.6	2.5
Height to Live Crown (m)	8.7	0.5
Canopy Bulk Density (kg/m ³)	0.24	1.25

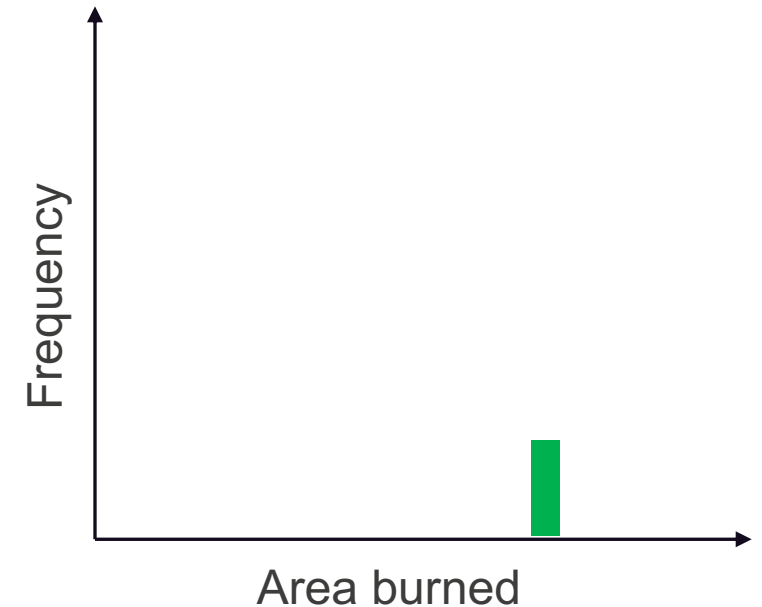
- Vary slope angle, fuel moisture, and ambient wind speed
- Setting homogenous grass layer at 5% fuel moisture; 0.3 m height
- Not considering litter



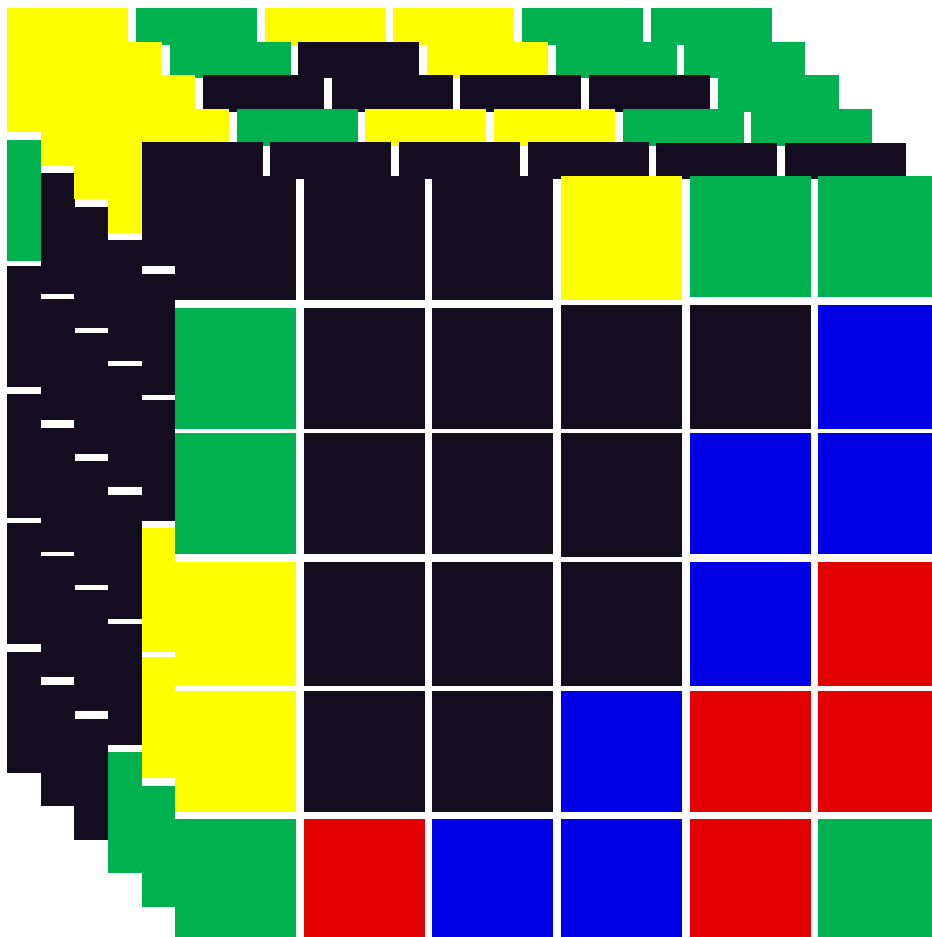
Future Work: “The Gadget”



- Example: Ignite a cell that has a 20% slope, shrub: FIRETEC says: this cell burns completely, so it can spread to its burnable neighbors.
- Repeat this process on the neighboring cells until fire does not propagate



Future Work: “The Gadget”



- Continue applying the response function over the cell varying ignition location and wind direction
- Record areas burned to create a distribution

